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(54) **Process for treating sharps and middlings from flour-milling and foodstuffs obtained therefrom**

(57) A method of treating the sharps and middlings from wheat flour milling comprises mixing them together and pulverising the mixture so that at least 85% of it passes through a 100 μ sieve and substantially all of it through a 400 μ sieve. The resulting product can be added to animal and human foodstuffs, especially bread and other bakery products, and acts as an aid to digestion.

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SPECIFICATION

Process for treating sharps and middlings from flour-milling and foodstuffs obtained therefrom

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The present invention relates to a process for treating sharps and middlings from flour-milling and, in particular sharps and middlings of soft wheat (*triticum sativum*), as well as to food products containing the resulting product and, in particular, to bakery products, such as bread, cakes, pastries, and pies.

As is well known, the treatment of cereals with a view to obtaining fine flour leaves at the end of the operation a certain amount of sharps and middlings obtained during milling, these sharps and middlings being composed essentially of husks, of which the brans represent the largest fraction (60 to 70%).

Though bran is widely used as a food and in particular as an animal food, this is not the case with the greyish-brown bran and the white bran (sharps and middlings obtained by the transformation or the milling of the semolinas) which are particularly rich in proteins and in enzymes such as acid phosphatase and β -amylase and which represent more than 30% of the sharps and middlings, i.e. about 8% of the weight of the wheat used.

Experiments carried out by the applicant have enabled him to show, moreover, that the nutritional value and in particular the enzymatic richness, and this not only for bran but also for middlings, — could be at least doubled if the active elements imprisoned in the milling could be "liberated".

The applicant also discovered that bread made from flours to which sharps and middlings from flour milling had been added presents, in relation to bread made from industrial flour (cylinder milling), very important advantages, not only in so far as digestibility is concerned but also as regards appearance of the crumb, flavour and keeping ability, and that these advantages are found in all kinds of bread: for example large loaves, English-type bread, brown bread, the french bread called "chaland" bread, wholemeal bread, fine wheaten bread, and sandwich loaves.

According to this invention there is provided a process for treating sharps and middlings from flour-milling, characterized in that all the sharps and middlings obtained during all the steps of milling the wheat are mixed and then reduced to fine particles of which at least 85% by weight will pass through a screen having 100 micron openings, and substantially all will pass through a screen having 400 micron openings.

If we take into account the fact that 100 kg of wheat gives on average 75 kg of flour and 25 kg of sharps and middlings, the sharps and middlings obtained separately during the extraction consist on average of:

60

4 kg of coarse bran
11 kg of fine bran
4 kg of greyish-brown middlings
4 kg of white middlings

65

1 kg of wheat germ

These sharps and middlings, mixed and homogenized, present the following characteristics (average of 100 different measurements):

a) *granulometry*

70

Size of the space between meshes of the sieve, in microns	% passing through
500	50.5
400	43
250	19.5
200	18
150	15
100	10

80 b) *Enzymatic characteristics*

Acid phosphatase	13.5 to 16.5 I.U./g
β -amylase	28 to 34 I.U./g

The enzymatic characteristics of each raw material — before mixing — are on average:

	Acid phosphatase (I.U./g)	β -amylase (I.U./g)
90 Coarse bran	5.4 to 6.4	16 to 20
Fine bran	16 to 20	25 to 31
Greyish brown middlings	16 to 20	36 to 44
White middlings	16 to 20	45 to 55

95

The mixture of the sharps and middlings, after crushing in accordance with the invention, presents the following characteristics (average of 100 different measurements):

100

a) *granulometry*

Size of spaces between meshes of the sieve, in microns	% passing through
500	99.5
400	99.4
250	97
200	94
150	93
100	88

b) *enzymatic characteristics*

115 Acid phosphatase	38 to 42 I.U./g
β -amylase	67 to 73 I.U./g

The wheat grains, before milling, are preferably washed in drinking water, using at least 2% of their milling weight of water.

On leaving the silos, the wheat is normally cleaned in the following way:

- dry removal of dust, straw, sand etc. . . .
- removal of foreign grains
- 125 — energetic brushing
- passing the wheat by a screw conveyor under a water spray of any known kind
- rest and drying (36 hours)
- brushing
- 130 — passing through the manufacturing procedure

The introduction of drinking water for washing the wheat improves the quality of the food product of the invention and the minimum quantity of water is that necessary for removing all traces of pesticides and insecticides in the raw materials.

The present invention also provides foodstuffs for human or animal consumption containing or formed by a mixture obtained in accordance with the process of the present invention.

Preferably the foodstuff, and especially bread and other bakery products, contains from 1 to 5% and more preferably from 1.3 to 1.7%, of the finely-divided mixture of sharps and middlings according to the present invention.

While retaining the economic advantages of milling the flour grains by means of cylinders, bread of an excellent appearance is obtained, provided with a thin golden crust representing 1/5 and 2/5 of the weight of the bread, having a homogenous, light and spongy crumb formed of membranes resistant enough to mastication to remain permeable to the digestive juices, having a sweet smell and a very pleasant flavour, i.e. if digestibility and excellent gastric tolerance are taken into account, bread of a quality superior event to that obtained with millstone ground flour.

The mixture according to the invention may also be mixed with the other foodstuffs, and may be enriched by vitamins, especially B-group vitamins.

The invention will be better understood with the help of the following description which gives an example of a method of carrying out the process of the invention, an account of tests carried out on animals, the characteristics of the flour to which the finely divided mixture of sharps and middlings has been added in accordance with the invention, as well as an account of clinical tests on man.

It is of course to be understood however that these examples and accounts are given solely by way of illustration and in no way limit the scope of the invention.

EXAMPLE OF PREPARATION

216 kg of sharps and middlings from flour milling composed of:

99 kg of fine bran
45 kg of coarse bran
36 kg of white middlings, and
33 kg of greyish-brown middlings

are finely pulverised in a pulveriser of the

ULTRAFINE V 50 type. The flow rate of the pulverised product is 140 kg per hour. The temperature of the air inside the pipes is of the order of 80°C, the temperature of the finished product of the order of 45°C.

Characteristics of the product obtained:—

Analysis	By Weight
Humidity	: 3%
Raw protein	: 15%
Cellulose	: 9%
Fats	: 4%
Minerals	: 4.5%
Non nitrogenous organic products	: 64.5%

The enzymatic content (acid phosphatase and β -amylase) is determined, using the same quantities and at the same times, for both the pulverised product and for the starting raw material. There was found:

a) acid phosphatase in m μ /ml of solution (modified BESSEY-LOWRY-BROCK method)

Time (in mins)	Starting material	Product of the invention
10	25	150
30	50	300
60	80	450

b) β -amylase: dosage by discolouring of a starch solution to which iodine at 37°C is added (method of SOMOGYI).

Time (in mins)	Starting material	Product of the invention
30	pure blue	purplish blue
60	purplish blue	violet
90	bluish violet	purplish-blue
120	violet	brown
150	purplish-blue	brownish
	brown	straw yellow

The granulometry obtained is the following:

Passing through the	Percentage
500 μ screen	99.8%
400 μ screen	99.5%
315 μ screen	98.5%
250 μ screen	97.2%
200 μ screen	94.3%
150 μ screen	93.2%
125 μ screen	90.5%
100 μ screen	88.3%

105 ACCOUNT OF TESTS CARRIED OUT ON ANIMALS

The tests were carried out on three groups of animals:

- 1) Piglets of 3 to 9 weeks:
100 animals treated and
100 control animals
- 2) Rabbits of 4 to 11 weeks:
100 animals treated and
100 control animals
- 3) Butchery calves from 1 to 12 weeks:
100 animals treated and
100 control animals

The doses used for adding to the normal food were 0.5% of the product of the invention for the piglets and 1% of the product of the invention for the rabbits and the calves.

The 100 controls received food containing 6% bran in the case of the piglets, 30% bran in the case of the rabbits whereas the food given to the calves contained no bran for it is strictly advised not to give bran to calves.

RESULTS

Animals	Foods in accordance with the invention	
	Gain in weight in relation to the controls (average)	Index of consumption in relation to the controls (average)
Piglets	+2%	-7%
Rabbits	+5%	-5%
Calves	+20%	-20%

5 The index of consumption shows the quantity of food used per animal for 1 kg of gain in weight.

The results given in the above table show that the treated animals have not only gained in weight in relation to the controls but have also consumed less food.

It should be noted that the enzymatic richness of

the product of the invention has a beneficial and practically immediate effect during the tests mentioned above. Moreover, the calves tolerated perfectly well the product of the invention: diarrhoea

was negligible, much less even than that noted in the control group.

TABLE II
Characteristics of the flour

Measurements	Cylinder flour A	A + 1.5% of sharps and middlings in accordance with the invention	Millstone flour
Ash	0.52%	1.55%	0.81%
Fats	1.15	1.19	1.64
KENT-JONES test (colouring)	1.75	5.1	6.4
Cellulose	0.27	0.40	0.54
Chopin Alveogramme	G:21.6 P:79 W:212 P/L:0.86	20.1 74 186 0.94	20.8 68 156 0.80
BRABENDER Amylogramme	1370	1280	1180

25 G: swelling index of the paste, expressed in ml
P: pressure measured in mm in relation to the resistance of the paste to deformation
L: length expressed in mm representing the average abscissa of breakage points
30 W: work necessary for the deformation of the paste, expressed in 10^{-4} joule.

It follows from this table that:

1) The alveogramme shows the fineness and the impermeability of the walls which limit

35 the alveoli of the bread (essential factors in the quality of the bread).

2) The cellulose content is markedly increased and approximates to that of the millstone.

3) The KENT-JONES tests shows a greyer colour than that of the flour before enrichment (this colour is found again during the bread making).

4) The amylogramme shows substantial diastatic activity.

TABLE III

Characteristics of the bread obtained

	Bread made with millstone flour	Bread made with cylinder flour	Bread made in accordance with the invention (cylinder + 1.5% middlings)
Outside appearance	Bread dull	Bread shining and golden	Bread shining and golden
Bread volume	1315 ml	1340 ml	1320 ml
Inside appearance	creamy grey	white	creamy grey
Cellular structure	uniform	heterogenous	uniform
Keeping qualities after 24 hrs after 48 hrs after 72 hrs	good average mediocre	good mediocre poor	very good good fairly good

5 The method of preparation, the weight of the starting flour, and other variables were strictly identical in making the bread from the three different types of flour.

10 It follows very clearly from the results given in table III above that the addition of sharps and middlings from flour-milling in accordance with the invention substantially improves the quality of the bread

obtained.

15 These results were confirmed by a new series of tests in which this time the qualities of the bread obtained were compared while adding

- 1) the sharps and middlings from flour-milling in accordance with the invention.
- 2) commercial fine bran.

TABLE IV

25 Comparison between the addition of bran and the addition of sharps and middlings from flour-milling in accordance with the invention (uniform addition : 1.5%)

	Control Cylinder flour	Addition of bran	Bread in accordance with the invention
Outer colour	shiny bread	shiny bread with visible particles	very homogeneous shiny bread
Keeping qualities after 24 hrs after 48 hrs after 72 hrs after 96 hrs	good mediocre poor very poor	good fairly good mediocre poor	very good good fairly good fairly good
REDUCING SUGARS 0 hour 60 min at 37°	CRUST CRUMB 100 100 172 137	CRUST CRUMB 106 172 105 177	CRUST CRUMB 109 184 115 190

30 It follows from this series of experiments that the bread of the invention is superior from the point of view of outside appearance, storage ability, and

reducing sugar content, not only in relation to the control, but also in relation to the bread to which
35 commercial bran has been added.

ACCOUNT OF THE EXPERIMENTAL STUDY OF BREAD OF THE INVENTION IN DIGESTIVE PATHOLOGY

The study covered 111 sick people of which 69
5 were men and 42 women and whose ages were the
following:

	20 years	: 1
	20-40 years	: 43
10	40-60 years	: 50
	60-80 years	: 16
	80 years	: 1

All these sick people suffered from a more or less
15 acute intolerance to cereal flours, bowel transit troubles (constipation 19%, diarrhoea 46%, alternation between constipation and diarrhoea 35%) and dyspeptic troubles (flatulence, intestinal gases, hypos-thenic dyspepsia).

20 The patients were divided into three groups:

Group 1 (34 patients) who, after questioning and clinical examination, were subjected for two consecutive days to a coprological examination with normal food then for a month on a diet strictly with-
25 out flour products. At the end of this period of a month, the patients were again examined and a further coprological study was carried out for two consecutive days. Then the group was subjected in a third phase to a diet similar to the preceding one, but
30 to which bread of the invention had been added and whose consumption from the point of view of quantity was quite free. At the end of this second month, group 1 underwent the last series of clinical and coprological tests.

35 Group 2 (70 patients) did not follow the intermediate flour-less step of the diet but went directly from their usual food to the diet containing the bread of the invention.

Group 3 (7 patients): control group.

40 RESULTS

The poor results were very few: 8 cases out of 104 patients, i.e. less than 8%. The reason for three of the failures was certain: the ingestion of the bread caused a recurrence of troubles determined by the
45 consumption of normal flour-containing foods. The reasons for the five other poor results were less certain because of the "fairly whimsical" diet of one of them and because of the very special psychological background of the others.

50 The good results numbered 96 and represent therefore over 92% of the cases. They were marked by the regularization of the intestinal transit and by the sedation of the painful manifestations and of the dyspeptic troubles, even of the gastric or associated
55 vesicular signs.

There was obviously no improvement in group III (controls).

COPROLOGICAL RESULTS

The dry weight of the stools after ingestion of
60 breads of the invention never showed any development towards diminution, i.e. towards liquid stools. No dry weight was ever noted below 15% and in numerous cases, it could be ascertained that the stools were better formed than previously, whereas
65 a diet overloaded with starchy foods could have

caused a distinct reduction of the dry weight, as is most often seen.

The organic acids, which usually indicate the fermentation of carbohydrates were studied especially
70 to find out if the bread of the invention, added to the flourless diet, caused their increase. The analysis showed that they were reduced in 54% of the cases, without modification in 26% of the cases, and increased in only 20% of the cases. It must be added
75 that the increases observed were always minor ones and that large fermentations above 25 mEq% were never found.

The clinical results show that the conventional flourless diet and the diet comprising bread of the invention have identical actions, with the result that, after improvement by the first, it is possible to adopt the second without compromising the improvement. This latter may also be obtained by going over directly to the diet comprising bread of the invention, which thus constitutes a check on the action of the breads of the invention.

It follows from the preceding description that whatever the mode of implementation, embodiment and application adopted, there are obtained,
90 on the one hand, additives for animal feeding which present in relation to the prior art the important advantages of being of a low cost price, of making use of all the sharps and middlings from flour-milling and of presenting very substantial activity as
95 food additives and, on the other hand, bakery products and especially breads having a very pleasing inner and outer appearance, a very pleasant flavour, very good keeping qualities and, a major fact, foodstuffs remarkable from the point of view of digestability.
100

CLAIMS

1. A process for treating sharps and middlings from flour-milling, characterized in that all the sharps and middlings obtained during all the steps
105 of milling the wheat are mixed and then reduced to fine particles of which at least 85% by weight will pass through a screen having 100 micron openings, and substantially all will pass through a screen having 400 micron openings.
2. A process according to claim 1, characterized in that the grains of wheat, before milling, are washed in drinking water, using at least 2% of their weight of water.
3. A mixture of sharps and middlings from flour
115 milling reduced to fine particles, of which at least 85% by weight will pass through a screen having 100 micron openings and substantially all will pass through a screen having 400 micron openings.
4. A mixture according to Claim 3, enriched with
120 B group vitamins.
5. A foodstuff containing a mixture according to Claim 3 or Claim 4.
6. Bread or another bakery product containing a mixture according to Claim 3 or Claim 4.
7. Bread or another bakery product containing
125 from 1 to 5% by weight of a mixture according to Claim 3 or Claim 4.
8. Bread or another bakery product containing from 1.3 to 1.7% by weight of a mixture according to
130 Claim 3 or Claim 4.

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